

Adaptive Management Team

Total Dissolved Gas in the Columbia and Snake Rivers

Evaluation of the 115 Percent Total Dissolved Gas Forebay Requirement

Response to Comments

January 5, 2009

The Washington State Department of Ecology (Ecology) and the Oregon Department of Environmental Quality (ODEQ) released a draft version of the *Evaluation of the 115 Percent Total Dissolved Gas Forebay Requirement* on September 4, 2008 for review by the Adaptive Management Team (AMT). The AMT met on September 9, 2008 to discuss the draft document. AMT members were asked to submit technical comments on the draft by October 6, 2008. Ecology and ODEQ received comments from six organizations: USACE, FPC, BPA, Northwest RiverPartners, CRITFC, and ODFW. The following response to comments summarizes the comments and that states' response to the comments. The complete comments are available on the AMT website, <http://www.ecy.wa.gov/programs/wq/tmdl/ColumbiaRvr/ColumbiaTDG.html>.

Executive Summary

Comment:

Page 8, Executive summary, paragraph 1, sentence 1: The sentence states that both the States of Oregon and Washington are “required to make a recommendation” on the need for the 115% TDG forebay limit. The Oregon DEQ was instructed to evaluate the need for the 115% forebay limit by the Oregon Environmental Quality Commissioners following testimony given at a public hearing on the TDG waiver in June 2007. The report should explain briefly why the State of Washington also considers this a “requirement”, or if there is another mandate driving their part of the process.

Response:

The Washington Department of Ecology received a petition to change its water quality standards for TDG in the forebay. Ecology agreed to study the issue and the petition was withdrawn. While there may not be a strict legal mandate currently, if Ecology did not address the issue, Ecology would likely receive another petition requiring it to address the criteria.

Comment:

Page 8, paragraph 2, sentence 1: The weight of evidence approach means weighing two or more arguments and giving greater weight to the most plausible and relevant argument. The draft report needs to show how this weighting has been done to answer the question of need for the 115% TDG forebay limit.

Response:

Ecology and DEQ agree with the comment, and have included a write-up on the Weight of Evidence approach and how it was implemented in the “Agencies’ Decisions” section of the report.

Comment:

Page 8, Executive Summary, paragraph 3, sentence 3: The original scope of the AMT question about the 115% TDG forebay limit included the PUD-owned dams in the Middle Columbia River, not just the Corps dams on the lower Snake and Columbia rivers. We were not aware that the scope of the question before AMT had been narrowed; please explain why this change occurred and how the Columbia River at the PUD dams will be considered.

Response:

The dams on the Middle Columbia are now specifically included in the document. In both the draft document and the final document, the majority of the analysis focuses on the dams in the lower Columbia and Snake Rivers.

Background

TMDL Overview

Comment:

Page 11, TMDL Overview, paragraph 1, sentence 1: The sentence is not correct. The TDG water quality standards for Oregon and Washington are not identical. As shown on page 9, Oregon’s TDG standard includes a limit of 105% TDG in hatchery receiving waters and other waters of less than two feet in depth. Also the Washington standard includes the 115%/120% forebay/tailrace limits as a criteria adjustment to aid fish passage over hydroelectric dams (Chapter 173-201A WAC, page 15). These additional criteria should be included in the Overview.

Response:

Ecology and DEQ agree with the comment, and have made the appropriate change in the document.

Comment:

Page 11, 5th Paragraph, 1st Sentence – Should be changed to: Spill events can...

Response:

Ecology and DEQ agree with the comment, and have made the appropriate change in the document.

Comment:

Page 11, TMDL Overview, paragraph 4: The report states, “Elevated TDG levels are caused by water flowing over the spillways (spill events) at hydroelectric dams on the Columbia and Snake rivers. Water plunging from a spillway entrains air causing increases in TDG.” To single out TDG produced from the spillway as the only source of TDG is an oversimplification of the TDG production on the Lower Columbia and Snake rivers. A more comprehensive understanding of TDG production, including natural sources, becomes especially important when considering data from the Camas Washougal area since it is a shallow reach and is affected by environmental factors. The Corps suggests that a new segment called, “Overview of TDG production” be added at the beginning of the “Background” section, with the following information included:

(See comment on the website for complete text.)

Response:

Ecology and DEQ agree with the comment, and have added a new section to the document titled, “Overview of TDG Production.” The text in this new section originated in the 2002 Lower Columbia River Total Dissolved Gas Total Maximum Daily Load document.

Comment:

Page 11, TMDL Overview, paragraph 5, sentence 2: Suggest the sentence be rewritten to state: “Voluntary” spills are provided to help meet juvenile fish survival goals. Spill is one of several fish passage strategies that improve passage conditions. It is not the only action available to aid fish passage. Also, juvenile passage performance standards in the 2008 FCRPS BiOp are percent survival levels for spring and summer migrants (96% spring and 93% summer).

Response:

Ecology and DEQ agree with the comment and have included the clarification in the new section titled, “Overview of TDG Production”.

TMDL Implementation

Comment:

Page 13, TMDL Implementation, paragraph 1, sentence 3: Edit the sentence: “...operational changes to dams to attempt to achieve the water quality standard for TDG.” It is unlikely that operations or structural changes at dams will fully achieve the 110%/105% TDG state standards without drastically modifying current spill regimes and impacting fish survival.

Response:

Ecology and DEQ do not agree with the comment, and have made no change to the document. The TDG TMDL states that: “Given the clear mathematical relationship between spill quantities, the load allocations (ΔP), and TDG percent saturation, compliance with load allocations will be met by specifying operational and structural goals for spills that prevent the load allocation from being exceeded. In general, the long-term goal of meeting water quality standards must be met with structural modifications to the dam projects”. (Page 60, 2002 Lower Columbia River TDG TMDL, <http://www.ecy.wa.gov/pubs/0203004.pdf>)

Comment:

Page 13, 3rd Paragraph, 1st Sentence – Should be changed to: ... as outlined in the BiOp through spill levels that generate...

Response:

Ecology and DEQ agree with the comment, and have made the appropriate change in the document.

Comment:

Page 13, 6th Paragraph, 1st Sentence – Should be changed to: Long term compliance with load allocations for voluntary spill will be at...

Response:

Ecology and DEQ do not agree with the comment. The TDG TMDLs identify the load allocations for each dam, defined site-specifically at the edge of the aerated zone. The TMDL load allocations only apply for flows below the 7Q10 flood flows, regardless of the cause of the spill. Therefore, long-term compliance with load allocations for dam spills will be at the downstream end of the aerated zone below each spillway. No change was made to the document.

Comment:

Page 13, paragraph 3, sentence 2: The report states, “The current TDG fixed monitoring station system consists of tailrace and forebay monitoring stations at each mainstem lower Snake and Columbia River dam. While most of these stations do a credible job of reporting meaningful data, some stations produce questionable data.” On page 17, there is also a statement questioning the forebay gage validity which says, “Although the forebay monitors were relocated and lowered deeper into the water column in 2004 and 2005, questions regarding their validity still exist.” The many on-site specific TDG exchange research studies, RPA 132 TDG studies and the continuing fixed monitoring station program have shown that forebay gages accurately reflect the TDG levels in the dominant aquatic habitat of the hydroelectric dams. The Corps data from the existing TDG fixed monitoring stations provide accurate and reliable data that meets the QA/QC standards established through the regional water quality forum process. The gages are calibrated every three weeks to a primary and secondary standard as established through the regional forum process; USGS and the Corps perform data quality reviews daily and the gage exceed the 95% data completeness standard.

Response:

Ecology and DEQ changed the text from “some stations produce questionable data” to “some stations may be affected by environmental variables” in order to reflect the research that has been conducted by the Army Corps of Engineers as part of RPA 132.

Need for Adaptive Management

Comment:

Also, the ODEQ and WDOE need to take into account that fish transportation is a necessary strategy to safely pass juvenile salmon and steelhead through the federal hydrosystem. Transportation is an important mitigation action that assures that juvenile salmon and steelhead get safely to the ocean under the variety of conditions experienced in the Snake and Columbia Rivers. Spill volumes and fish transportation are inextricably linked. Increasing spill will result in decreased collection of fish for transport. Transported fish have a 98% survival rate to below Bonneville Dam. The most recent estimates indicate that in-river migrating Snake River spring/summer chinook had a survival rate of 41.6% from Lower Granite to Bonneville Dam (NOAA-F 2008a). Snake River steelhead had an in-river survival rate of 45.5% over the same portion of river. Increasing spill will expose more juvenile fish to lower in-river survival rates; thereby reducing the total number of juvenile salmon and steelhead reaching the ocean.

Response:

Ecology and DEQ understand that transport was included in some of the analyses that were presented at the TDG AMT. However, Ecology and DEQ identify transport as a management

decision, which is discussed and decisions are made outside of the TDG AMT process. No change was made to the document.

The Adaptive Management Team

Comment:

Page 16, paragraph 3, sentence 2: Add the Fish Passage Center to the list of regular attendees.

Response:

Ecology and DEQ agree with the comment, and have made the appropriate change in the document.

Comment:

Page 16, 2nd Paragraph, 2nd Sentence – Douglas PUD is misspelled and FPC should be listed as one of the regular non-member attendees to AMT meetings.

Response:

Ecology and DEQ agree with the comment, and have made the appropriate change in the document.

Forebay Gauge History

Comment:

Page 16, Forebay Gauge History, paragraph 1, sentence 1: The sentence says, “Currently, there is no one single entity researching the validity (representativeness) of the forebay monitors. However, several past studies evaluated the application and use of the forebay monitors as it relates to fish passage spill.” This statement does not properly reflect the extensive and consistent actions the Corps has taken to establish the accurate and representative fixed monitoring station system that exists today. The Engineering Research and Development Center (ERDC), formerly Waterways Experiment Station (WES), of the US Army Corps of Engineers performed 28 TDG exchange research studies on forebay and tailwater gages on the Lower Columbia and Snake Rivers. The Corps spent millions of dollars over a eleven year period (1996 to 2007) studying the impacts of project operations on total dissolved gas loading, TDG exchange processes and representativeness of the gages. These TDG research studies had multiple transects, with each transect containing multiple (2 to 8) gages that were installed to measure the TDG levels at different points across the river. Consistently, these research studies showed variability in TDG levels from gage to gage within the transect. The variability of TDG levels were found to be minimal with the forebay transect gages but more pronounced in the tailwater transect gages. These results reflect the fact that high TDG levels are generated from the spillway and forebay TDG levels are carried through the powerhouse so that TDG levels can be different at different points in the tailrace.

Response:

Ecology and DEQ agree with the comment, and have made the appropriate change in the document.

Comment:

Corps studies have demonstrated that the forebay gages as currently configured accurately reflect the TDG levels in the dominant aquatic habitat of the hydroelectric dams. BPA supports the Corps findings.

Response:

Ecology and DEQ agree with the comment, and have made the appropriate change in the document.

Information the AMT Considered

Comment:

Page 18, question 2, paragraph 1: Additional spill will not increase fish passage; instead, it may increase the proportion of fish using the spillway to pass a dam. This could decrease survival at projects with lower spill survival. In the last sentence, increased TDG may increase sublethal, chronic toxicity effects, not just gas bubble trauma, in aquatic species.

Response:

Ecology and ODEQ made minor changes to make it clear that additional spill may increase fish survival. Ecology and ODEQ understand that additional spill does not always lead to increased survival in every situation. Gas bubble trauma includes both the acute and the chronic, sublethal effects. We understand that chronic, sublethal effects are not necessarily identified by monitoring fish fins for signs of GBT.

Comment:

Page 18, paragraph 2, bullet 3: CSS = Comparative Survival (not Comparable Survivability) Study

Response:

Ecology and DEQ agree with the comment, and have made the appropriate change in the document.

Spill Volume Considerations

Comment:

Page 18, Spill Volume Considerations: It is unclear what the purpose or message is in this section of the report. It states that setting or limiting spill volumes will occur in other FCRPS forums and not at AMT. This is correct for specific project spill discharge rates or percentages for fish passage. However, decisions on TDG limits can result in changes to levels of spill at projects, which in turn may have positive or negative impacts on fish survival and adult returns.

At Lower Monumental Dam, for example, higher spill levels will mean less transportation of juvenile fish. The COMPASS analysis completed for AMT showed a very small increase in Snake River spring/summer Chinook with this operation, but a larger decrease in survival for Snake River steelhead which greatly benefit from being transported below Bonneville Dam. This may be a consequence of further relaxing the TDG limit from where it is now, if the Action Agencies decide to manage spill up to the more relaxed TDG limits. The states should factor this effect into their decision.

Response:

Ecology and DEQ included the “Spill volume consideration” section in the report to inform the reader on terminology used regarding spill. Ecology and DEQ understand that TDG limits have the potential to result in changing levels of spill at projects, however Ecology and DEQ are not setting levels of spill through the evaluation of the 115% TDG forebay limit TDG AMT. Ecology and DEQ identify that the setting of spill volumes and transport are a management decision, which are discussed and decisions are made outside of the TDG AMT process. No change was made to the document.

Spill Volume Analysis: With and Without the 115 Percent TDG Limit

Comment:

Page 20, 2nd Paragraph, 3rd Sentence: word “data” after TDG is redundant

Response:

Ecology and DEQ agree with the comment, and have made the appropriate change in the document.

Comment:

Page 20, 3rd Paragraph, 1st Sentence: Should be changed to: ...directly comparing the spill volumes from the different analyses, given the differences in assumptions used for each analysis.

Response:

Ecology and DEQ agree with the comment, and have made the appropriate change in the document.

Comment:

Table 2, Row: FPC, Column: Data Set: For clarification, should mention that over-generation spill was not included in any of the scenarios modeled by FPC.

Table 2, Row: USACE, Column: Data Set: For clarification, should mention that over-generation spill was included in the modeled scenario.

Response:

Ecology and DEQ agree with the comment, and have made the appropriate change in the document.

Comment:

General Comment: It should be noted that the metrics provided in the discussions of the different modeling efforts are different. The figures provided for the FPC analysis present the percent increase in spill for each of the modeled scenarios, compared to the base case. However, the figures provided for the USACE analysis present the different seasonal estimates of percent spill for each of the modeled scenarios. These figures also show an absolute difference between the two scenarios. Given these differences in presentation, it should be made clear that the different figures cannot be directly compared.

Response:

Ecology and DEQ agree that not all the percentages can be directly compared. Ecology and DEQ made changes to the document to make it more clear what should and should not be directly compared. All figures now use the following definition of increase in spill:

$$\frac{\text{Spill Volume (KAF) of 120\% only Scenario} - \text{Spill Volume (KAF) of 115 \& 120 Base Case}}{\text{Spill Volume (KAF) of 115 \& 120 Base Case}}$$

Figures 7-9 and Table 4, which presented information in different ways, were deleted. Ecology and DEQ also added the calculation for each percent increase (TDG, GBT, survival, etc) provided in the report.

FPC Analysis

Comment:

Page 22: The synthesis report says, “The FPC ran scenarios with differences in planned operations ranging from the base case (what was actually implemented in that year) to what would occur if there was no spill management except for the 120% TDG requirement (meaning projects were not managed to a specific spill program but spilled the full volume of water to the 120 % TDG). The non-baseline scenarios were defined as:

Scenario B: Spill that would have occurred if all projects spilled to the 120% cap on days when spill was restricted by the 115% downstream forebay (but not the 120% tailrace)

Scenario C: Spill that would have occurred in that year if all projects spilled to the 120% cap (limited by planned operations).

Scenario D: Spill that would have occurred in that year if all projects spilled to the 120% cap (not limited by planned operations).”

These descriptions need to be more comprehensive so that readers are able to understand why the Fish Passage Center can estimate an additional 5.9 to 58.0 MAF will result from removing the 115% TDG standard when the Federal analysis says that an additional 0.4 to 5.0 MAF will occur. The additional descriptions that should be included are: An Excel spreadsheet was used to estimate changes in spill volumes; involuntary spill was removed from all scenarios; one spill cap per project was used for all scenarios in all years; Scenario A and B used the spill operations for the years studied; Scenario C used some spill operations proposed in litigation; scenario D replaced the current 2008 FCRPS Biological Opinion required spill operations with a 24/7 spill to the gas cap spill regime. Since spillways may not be the highest survival passage route at a project, more spill does not necessarily improve fish passage.

The Fish Passage Center’s scenarios C and D in their spill analysis modified current required spill operations. Information from these two scenarios was used throughout the states’ synthesis report. The inclusion of information on Fish Passage Center’s scenario C and D is inappropriate, confusing and misleading since modifying required spill operations is not part of the discussion of whether the 115% TDG standard is needed. As a result of including scenario C and D Table 3 on page 22 shows additional spill of 5.9 to 58.0 MAF would occur if the 115% forebay TDG standard was removed. Based on many SYSTDG modeling simulations, it is necessary to modify required spill operations to gain 5.9 to 58 MAF of additional spill *in addition to* removing the 115% TDG standard. Spill operations are an archetype of the “management issues” that WDOE and ODEQ have said are not within the AMT’s purview.

In conclusion, the only way to achieve the very high spill volumes in the FPC’s Scenarios C and D is by ignoring the reality of involuntary spill in circumstances where flow is greater than turbine or market capacity, and by altering the 2008 FCRPS BiOp spill regime *in addition to* removing the 115% forebay TDG standard in circumstances when flow is less than turbine or market capacity. Altering spill operations is precisely the sort of “management decision” that WDOE and ODEQ have said is not under their purview.

Response:

Ecology and ODEQ added additional detail to both Table 2 and the FPC Analysis section of the report to provide more details. The four scenarios the FPC used are more thoroughly described in documents 823 and 303, available on the AMT website. We do not agree that inclusion of scenarios C and D are entirely inappropriate, confusing, and misleading. While scenarios C and D do not represent the most likely near-term result of eliminating the 115% requirement, they do help explain what could happen under different situations. The Agencies' Decision section addresses this issue in more detail.

Comment:

Page 22, 2nd Paragraph, 2nd Sentence – Typo: delete extra s in first set of parentheses, before “specific”).

Response:

Ecology and DEQ agree with the comment, and have made the appropriate change in the document.

Comment:

Spill volumes calculated by the Fish Passage Center were made without proper consideration of both power and non-power constraints to the federal hydrosystem See Corps comments, document 404). The FPC admitted they did not consider overgeneration spill (forced spill) because they suppose that BPA could not guarantee this type of spill would occur in future years. FPC opinions on future market conditions are based on conjecture and should be disregarded. Theirs was a theoretical exercise based on selective data; the results should not be considered in your decision making process.

Response:

All analyses submitted during the TDG AMT process have been considered in the decision making process. Ecology and ODEQ understand the assumptions and limitations of each analysis. No change was made to the document.

USACE Analysis (SYSTDG)

Comment:

You requested that comments also be made on the accuracy of conclusions drawn from the presentations made to the Adaptive Management Team (AMT). We would like to suggest that the scope of the analysis conducted by Bonneville Power Administration, the U.S. Army Corps of Engineers and NOAA Fisheries (Action Agencies) was too narrowly focused on the spill volumes provided in the 2008 Biological Opinion. This Biological Opinion contains spill amounts that are substantially less than provided since 2005 under the Court Ordered spill program. The Biological Opinion constrains spill during the peak of the spring migration to increase transportation. The Water Quality Agencies have specifically stated that they do not intend to address transportation in the AMT. Therefore, analyses to determine the benefits of spill under alternative TDG constraints should be done under a full range of spill operations including those provided in recent years under the Court Order where spill is not interrupted to maximize transportation.

And

Given that there is question regarding the best operational spill scenario to implement in the near future, the DOE and DEQ should consider the entire breadth of possible changes in survival that could occur under the implementation of alternative spill programs. This would give you a broader foundation upon which to see the potential benefits of increases in fish survival using other possible scenarios than just the 2008 Biological Opinion.

And

We have concerns that the analysis of spill volumes and salmon survival offered by the federal agencies (NOAA Fisheries, BPA and the Corps) is limited to the 2008 Biological Opinion spill. Recently the Independent Scientific Advisory Board of the Northwest Power and Conservation Council reached the conclusion that Court ordered spill, which is considerably higher than 2008 Biological Opinion spill in the Snake River during May, continue at least until smolt-to-adult survivals for juveniles afforded Court spill can be analyzed (ISAB 2008-5; Attachment). Because the COMPASS model uses fish survival data before the Court ordered spill was implemented, as we and others have stated, the model results do not reflect the status quo Court ordered spill levels. This has resulted in the COMPASS model predicting higher steelhead survivals with less spill, since in COMPASS, steelhead survival from transportation is higher than in spill/in-river migration. This may result in a spill change to the 2008 Biological Opinion that is important to consider with and without the 115% TDG requirement.

And

Thus, we recommend that Ecology and DEQ review spill scenarios with and without the 115% TDG requirement that include the Court ordered spill levels to best determine potential effects to the fisheries beneficial use. This could be of assistance in comparing the different analytical methods, (FPC, SYSTDG, HYSIM) as the same starting assumption (i.e. court ordered spill levels) could be utilized. This could be useful for comparing, for instance, overgeneration spill.

Response:

The FPC analysis included spill volumes that do include a full range of spill operations and are not set by the 2008 BiOp. This analysis, plus the USACE analysis that does include the 2008 BiOp, helps provide a

complete picture of the potential effect of the 115% TDG forebay requirement. While it would be beneficial for all the analyses to address all of the years, spill assumptions, and spill operations, the information that the AMT collected provides sufficient information to understand the issue. No change was made to the document.

Comment:

Page 25, USACE Analysis (SYSTDG), paragraph 1, sentence 2: The statement is not correct. The Fish Passage Center commented on the Corps' draft analysis (AMT document # 620).

Response:

Ecology and DEQ agree with the comment, and have made the appropriate change in the document.

Comment:

Page 25, USACE Analysis (SYSTDG), paragraph 2, sentence 2: The date of the draft BiOp used in the Corps' analysis was October 31, 2007, not March 17, 2008.

Response:

Ecology and DEQ made the change in the document.

Comment:

Page 26, Figure 6: This figure shows the increase in spill (Percent increase over base case) based on Corps SYSTDG analysis of spill volumes. The Corps was not able to duplicate this graph as a seasonal average and it appears that the highest monthly percentage averages were used to create this graph. If this is the case, then it is not a proper representation of the SYSTDG model results.

Response:

Figure 6 is based on the "totals in KAF" from Tables 11-13 of the *Report on the SYSTDG Modeling for AMT*, document 710. These are annual totals.

Comment:

Pages 27 – 28 and 42 - 44: Figure 7 – 9 on page 27 - 28, Table 12 and 13; and Figures 16 and 17 on page 42 – 44 need to be labeled seasonal averages (absolute).

Response:

Figures 7-9 were deleted. Additional information was added to Tables 12 and 13 and Figures 16 and 17 to define how the difference was calculated.

Comment:

Page 28, Table 4: This table needs to be labeled absolute percentage of water spilled.

Response:

Since Table 4 is redundant and presented information in a different way that was confusing, it was deleted.

Comment:

The Corps and BPA worked together using actual tools used to manage river operations in the federal hydrosystem to identify the volume of water available if the 115% TDG forebay standard was eliminated. Their results represent the most accurate estimate of the actual volume of water that would be available if the 115% TDG forebay standard was removed. For this joint federal analysis, the two agencies ran their water management models consecutively to provide actual spill operations used to assess the difference between operating forebays to 115% versus 120% TDG limitations. The SYSTDG results identify the spill caps under which the dams can theoretically be operated. HYDSIM is then used to produce actual project outflows and total spill volumes based on real world conditions.

Response:

Comment noted. The SYSTDG and HYDSIM analyses, along with the FPC analysis, are used in the report.

BPA Analysis (HYDSIM)

Comment:

Page 29, Figure 10: In this figure, HYDSIM Analysis is a better description than the current label of “BPA calculated”.

Response:

Ecology and DEQ agree with the comment, and have made the appropriate change in the document.

Comment:

Page 28, 2nd Paragraph, 2nd Sentence – Should be changed to: ...data to generate monthly average flow...

Response:

Ecology and DEQ agree with the comment, and have made the appropriate change in the document.

Synthesis of FPC, USACE, and BPA Analyses of Spill Volumes

Comment:

Page 29: The descriptions on Table 5 and 6 on page 29 could be more informative by using FPC – Excel spreadsheet instead of FPC; BPA - HYDSIM instead of BPA; and USACE – SYSTDG instead of USACE.

Response:

Ecology and DEQ agree with the comment, and have made the appropriate change in the document.

Comment:

Page 29, Table 6: This table needs to be labeled relative to percentage additional spill amount. Also, using a percent of a percent is not a statistically reliable methodology.

Response:

Ecology and DEQ made changes to the document to make it more clear how the statistics were calculated. All figures now use the following definition of increase in spill:

Spill Volume (KAF) of 120% only Scenario – Spill Volume (KAF) of 115 & 120 Base Case
Spill Volume (KAF) of 115 & 120 Base Case

Comment:

Page 30, paragraph 1: The Corps agrees that the states need to be careful in using the spill volume analyses in making a decision on the 115% TDG forebay limit. However, the issue is not so much how to compare analyses as it is which of the analyses are most valid and relevant to the question before the states? The report does not discuss this aspect of the information at all, and it needs to. Which assumptions in the studies are the most valid to the specific question before AMT? Results were quite different between the NOAA/BPA/Corps analyses and those provided by the Fish Passage Center, USFWS, and CRITFC. The report needs to weigh in on the information provided, and do more than simply recite what data were presented at the meetings. This is true for both the physical and biological information. Such an assessment is lacking in this report, and it is key to making a defensible decision. Moreover, the states' report should acknowledge that SYSTDG and HYDSIM are management tools that are regularly used to determine FCRPS operations, often on a daily basis. An additional issue is that, while comments on the presentations were acknowledged, and there were a lot of them, the states do not report doing anything with the comments. How were the comments considered? Which were the most relevant and valid in providing insight to the question before the states? This needs to be explained in the report as well.

Response:

The assessments that the commenter requests are included in the Agencies' Decisions section of the document. Ecology and ODEQ did receive many comments on the analyses submitted at AMT. Ecology and ODEQ read each comment and frequently requested additional information from either the entity that did the analysis or the commenter. Originally, Ecology and ODEQ summarized the comments, and the responses to comments, in the document. However, these discussions greatly increased the length of the document. Since the purpose of the document is to provide a digestible synthesis of the information, we decided to remove the discussion of the comments. Ecology and ODEQ understand the issues in the comment letters, and the comments help inform the Agencies' Decisions. The comments and the responses to the comments are all available on the AMT website.

Comment:

Two differing spill volume analyses, one by the COE and BPA and the other by the Fish Passage Center, provide the most pertinent differences in information submitted to the AMT. The vastly different volumes of spill increases demonstrated by these analyses "set the stage" for the dissimilar results regarding juvenile survival found in subsequent analyses.

There are two primary differences between the COE/BPA analyses and the FPC analysis:

- 1.) Involuntary spill is removed from the FPC analyses. This is a *modification* of the actual operation that occurred in the years the FPC analyzed, in so much that involuntary spill occurred in those years. Indeed, involuntary spill occurs in all but the lowest of water years. The COE and BPA analyses incorporated the reality of involuntary spill.
- 2.) The FPC ignores 2008 FCRPS BiOp spill operations. NOAA Fisheries has approved this spill regime (with substantial input from the region) and has found that it will avoid jeopardy to listed salmonids and put them on a trend towards

recovery. The Action Agencies are legally obligated to follow NOAA's 2008 FCRPS BiOp spill regime.

- Because the FPC analysis uses different spill regimes and removes involuntary spill it vastly overstates the amount of "fish spill" that would occur in the FPC's Scenarios C and D.
- The FPC's overstatement of spill volumes occurs in two operational circumstances:
 - The first is under conditions when flow is *greater than* turbine or market capacity.
 - In the COE and BPA analyses this flow passes a dam as involuntary spill.
 - In the FPC's analyses there is no involuntary spill, so any spill is automatically derived from flow that is assumed to otherwise be used to generate electricity and therefore becomes voluntary "fish spill."

- The second is when flow is *less than* turbine or market capacity.
 - The COE and BPA analyses use the spill regime delineated by NOAA Fisheries in the 2008 FCRPS BiOp.
 - The FPC replaces these required spill operations with an unspecified spill operation in Scenario C, and with a 24/7 spill to the gas cap operation in Scenario D.

- In conclusion, the only way to achieve the very high spill volumes in the FPC's Scenarios C and D is by ignoring the reality of involuntary spill in circumstances where flow is greater than turbine or market capacity, and by altering the 2008 FCPRS BiOp spill regime *in addition to* removing the 115% forebay TDG standard in circumstances when flow is less than turbine or market capacity. Altering spill operations is precisely the sort of "management decision" that WDOE and ODEQ have said is not under their purview.

Response:

While scenarios C and D do not represent the mostly likely near-term result of eliminating the 115% requirement, they do help explain could happen under different situations. Ecology and ODEQ understand the assumptions that went into each analysis. The Agencies' Decision section addresses this issue in more detail.

Fish Passage and Survivability Impacts

FPC Analysis of Juvenile Hydro-system Survivals and SARs

Comment:

The FPC also did not provide a quantitative estimate of the benefit additional spill volumes. Instead, they inferred significant benefits to fish survival through small increases in spill. Dr. Jim Anderson, of the University of Washington, School of Aquatic and Fishery Sciences, stated in his May 3, 2008 comments on the FPC analysis that a 28% increase in spill resulting in a 1000% increase SAR for steelhead was "exceedingly optimistic." Dr. Anderson concluded his summary by stating that...*"It is noteworthy that to the best of my recollection the proposed benefits of spill in this analysis exceed all claims ever made by any agency over the past 25 years."*

Dr. John Skalski, also of the University of Washington, School of Aquatic and Fishery Sciences, conducted a review of the statistical analyses of the FPC presentation. He noted in his March 3, 2008 review that...*"The resulting conclusion that spill is a good predictor [of juvenile fish survival] is circular in logic, and thus cannot be supported."*

Analyses on the benefits of spill provided by the FPC and USFWS are based on conjecture and greatly exaggerate the benefits of spill. Further, the FPC did not provide the requested quantitative estimate of the benefits to fish by removing the 115% TDG forebay limit. The results of these analyses should not be considered in your decision making process.

Response:

Ecology and DEQ have read the comments submitted by Dr. Anderson and Dr. Skalski from the University of Washington. Both the FPC and USFWS responded to the University of Washington Comments and the responses are posted on the TDG AMT website: documents "[FPC response to previous BPA comments on FPC's importance of spill presentation](#). (619)" and "[USFWS response to previous BPA comments on CSS](#). (615)." The FPC and USFWS studies are based on empirical and modeled data sets as identified in Table 7 "Fish Passage and Survival Impacts Analysis Summary" in the draft TDG AMT document. All analyses submitted during the TDG AMT process have been considered in the decision making process. The FPC and others provided a quantitative estimate of the benefit of additional spill during the comment period. This analysis is included in the document.

Comment:

Pages 34 – 35, Figures 13 – 15: These relationships are not relevant to the AMT spill question if the year 2001 is included. It was an extremely low flow year with very little project spill. Analyses with 2001 removed show little relationship between spill and water travel time with survival. Also the spill changes likely to occur from removing the 115% TDG forebay limit are very small relative to the ranges on the graphs.

Response:

Ecology and DEQ asked FPC to remove the 2001 spill data from their original analysis. The updated analysis showed that by removing the 2001 data from the original FPC analysis had very little impact on the estimates of the relationships, see "[FPC Response to Figures 13-15](#) (822)" document posted on the TDG AMT website. No change was made to the document.

CSS Study Presented by USFWS

Comment:

The USFWS also presented an analysis of the benefits of additional spill volumes based on the Comparative Survival Study (CSS). The CSS has been critically reviewed by several independent research organizations in the region. In a June 29, 2007 review of the CSS study, Dr. Usha Varanasi, Science and Research Director for the NOAA-F Northwest Fisheries Science Center stated that:

"The data presented, and the discussion and conclusion section all seem focused through the lens of specific positions favored by the authors: hydropower-system related latent mortality is large in magnitude, transportation

*is not beneficial, management actions directed at the hydropower system have generally failed,”... and
“Results that do not support desired positions are usually discounted by carefully placed language.”*

The estimated benefits of additional spill volumes developed by the USFWS are based on analytical tools which are not well received in the region. Furthermore, the USFWS did not provide the requested quantitative estimate of the benefits to fish by removing the 115% TDG forebay limit. The results of these analyses should not be considered in your decision making process.

Response:

Ecology and DEQ have read the comments submitted by Dr. Usha Varanasi on June 29, 2007 to Robert Lohn, document “[NOAA NWFSC comments on CSS](#) (621)” on the TDG AMT website. A response to Dr. Usha Varanasi’s comments was provided and is available on the TDG AMT website, “[FPC response to CSS comments by NOAA](#) (626).” Most of the comments received at the TDG AMT on the CSS report were developed during the regional CSS study review during the summer of 2007. The CSS team incorporated many of the comments received by the AMT originating in 2007. Although the CSS study uses regionally accepted analytical methodologies, regional opinion on the use of the CSS study remains controversial. The FPC and others provided a quantitative estimate of the benefit of additional spill during the comment period. This analysis is included in the document.

Comment:

Page 35, 3rd Paragraph, 1st Sentence – We suggest a different way of presenting the conclusion from this presentation:

The conclusion presented was that if percent spill were increased (at a given level of flow), fish travel time would be shorter (both species, both reaches), instantaneous mortality rates would be lower (steelhead: Lower Granite-McNary), and juvenile survival rates would be higher (both species, both reaches). The impact of this increase in percent spill on fish travel time, instantaneous survival, and juvenile survival is dependent on the flow.

Response:

Ecology and DEQ have made the appropriate change in the document.

Comment:

The Fish Passage Center worked other with some of the fish and wildlife agencies to develop their own separate analysis. This group chose to estimate additional spill volumes utilizing more simplistic analytical tools not developed to properly model the federal hydrosystem. They then provided general information on the benefits of spill. The group did not quantify biological benefits of removing the 115% TDG forebay limit. As a result, their claims on the benefits of spill are exaggerated and based on speculative analysis which should not be given weight in the state’s decision.

Response:

Ecology and DEQ do not agree. The FPC's statistical analysis was based on the use of the empirical data set. All analyses presented at the AMT were considered by Ecology and DEQ. No change was made to the document.

Comment:

The CSS study quantified the effects of spill on juvenile yearling Chinook and steelhead in the Snake River (Lower Granite to McNary dams) and on yearling Chinook in the lower Columbia River (McNary to Bonneville dams). However, spill effects for steelhead in the Lower Columbia were not identified in the CSS, likely due to the low sample sizes. As can be seen in the Table 1 below, the CSS analyses predict that the absolute increase in juvenile yearling Chinook survival from Lower Granite Dam to McNary Dam would range from 0% to 4%, dependent on the spill scenario and flow year chosen (see Fish Passage Center February 6, 2008 memo, AMT document 303, for a complete description of flow years and spill programs used) and would range from 1% to 9% for steelhead. This contrasts with the 0.2% for yearling Chinook, and 0.1% for Steelhead, estimated by COMPASS and presented by the Action Agencies for the same river reach. The CSS analyses also predict an increase of 0% to 5% for yearling Chinook in the Lower Columbia in contrast to no increase simulated by COMPASS.

In addition, the CSS analyses predict that the juvenile yearling Chinook travel time from Lower Granite Dam to McNary Dam would decrease by 0.2 to 1.9 days, dependent on the spill scenario and flow year chosen, and would decrease by 0.1 to 0.8 days for steelhead. The CSS analyses also predict a decrease of 0.2 to 2.2 days for yearling Chinook in the Lower Columbia.

The CSS results illustrate that the benefits to juvenile, and subsequently adult, salmonid survival are a function of the assumption made regarding spill level. The DOE and DEQ, when developing the Agencies' recommendation, must consider the full range of potential benefit to salmon from changes in the 115% forebay and 120% tailrace total dissolved gas management. In summary, it is apparent that the narrow scope of the assumption used for spill program implementation affected the simulated results obtained from the COMPASS model. Other analyses (e.g., the CSS) indicate substantial improvements in yearling Chinook and steelhead survival with increases in the percentage of spill.

		Absolute increase in survival (%) from base case		
		FBRestricted	120 limited	120 Unlimited
Lower Granite to McNary				
2003	Steelhead	0%	3%	8%
2005	Steelhead	0%	2%	5%
2006	Steelhead	1%	2%	6%
2007	Steelhead	2%	4%	17%
AVG		1%	3%	9%
wild				
2003	Yearling Chinook	0%	1%	3%
2005	Yearling Chinook	0%	1%	3%
2006	Yearling Chinook	0%	1%	2%
2007	Yearling Chinook	1%	2%	7%
AVG		0%	1%	4%
hatchery				
2003	Yearling Chinook	0%	1%	3%
2005	Yearling Chinook	0%	1%	3%
2006	Yearling Chinook	0%	1%	3%
2007	Yearling Chinook	1%	2%	7%
AVG		0%	1%	4%
McNary to Bonneville				
2003	Yearling Chinook	0%	1%	5%
2005	Yearling Chinook	0%	2%	7%
2006	Yearling Chinook	0%	1%	2%
2007	Yearling Chinook	0%	1%	4%
AVG		0%	1%	5%

Table 1. Absolute percentage increase in juvenile survival expected under different spill scenarios. Spill scenarios as described in Fish Passage Center AMT presentation on December 13, 2007. (Note: no planned spill occurred at Lower Granite, Little Goose and Lower Monumental dams during the spring of 2005.)

Absolute decrease in fish travel time (days) from base case				
			120	120
		FBRestricted	limited	Unlimited
Lower Granite to McNary				
2003	Steelhead	0.0	0.3	0.7
2005	Steelhead	0.0	0.2	0.6
2006	Steelhead	0.1	0.2	0.5
2007	Steelhead	0.2	0.4	1.5
AVG		0.1	0.3	0.8
wild				
2003	Yearling Chinook	0.1	0.7	1.6
2005	Yearling Chinook	0.0	0.6	1.6
2006	Yearling Chinook	0.2	0.5	1.3
2007	Yearling Chinook	0.5	0.8	3.2
AVG		0.2	0.7	1.9
hatchery				
2003	Yearling Chinook	0.1	0.7	1.8
2005	Yearling Chinook	0.1	0.7	1.8
2006	Yearling Chinook	0.2	0.7	1.7
2007	Yearling Chinook	0.6	1.0	3.6
AVG		0.2	0.8	2.2
McNary to Bonneville				
2003	Yearling Chinook	0.1	0.2	1.2
2005	Yearling Chinook	0.0	0.4	1.5
2006	Yearling Chinook	0.1	0.2	0.4
2007	Yearling Chinook	0.0	0.1	0.9
AVG		0.1	0.2	1.0

Table 2. Absolute decrease in fish travel time under different spill scenarios. Spill scenarios as described in Fish Passage Center AMT presentation on December 13, 2007. (Note: no planned spill occurred at Lower Granite, Little Goose and Lower Monumental dams during the spring of 2005.)

Response:

Ecology and DEQ agree that the full range of analyses and results presented at the TDG AMT are to be considered in the agencies' decision. Ecology and DEQ will accept the data presented in the comment regarding the absolute increase in survival and absolute decrease in fish travel time if the 115% TDG forebay limit was removed. This information allows for a full range of results analysis between COMPASS and CSS. The document was updated to include the information provided. Additional information is available on the website. Figure 15 and some associated text was deleted.

NOAA COMPASS Study

Comment:

In summary, the DOE and DEQ, when developing the Agencies' recommendation, should consider the full range of potential benefit to salmon survival from changes in the 115% forebay and 120% tailrace total dissolved gas management. The narrow scope of the assumptions used for spill affected the simulated results by the Action Agencies using the COMPASS model. Other analyses (e.g., the CSS) indicate substantial improvements in juvenile Chinook and steelhead in-river survival as the percentage of spill increased.

Response:

Ecology and DEQ agree that the full range of analyses and results presented at the TDG AMT are to be considered in the agencies' decision. No change was made to the document.

Comment:

NOAA-F found that overall survival of juvenile Snake River spring/summer chinook and steelhead would decrease by about 1% if spill was managed to 120% in the forebays. The adult return rates for these two stocks were estimated to respond differently. The adult return rate for Snake River steelhead would *decrease* an estimated 1.1%. The survival to adult return rate for Snake River spring/summer chinook was estimated to increase 0.8%. Juvenile salmon and steelhead originating from the Upper and Mid Columbia River were estimated to experience a neutral effect or slight positive (<0.2%) increase in in-river survival and adult return rates (<0.8%) from the increased spill volumes.

Response:

The COMPASS results presented in the comment are already presented in the "Draft Evaluation of the 115 Percent Total Dissolved as Forebay Requirement" document on page 39, Table 10. No change was made to the document. Ecology and DEQ will use the full range of analyses and results presented at the TDG AMT in the agencies' decision.

Comment:

Page 36, paragraph 3: Zero change in survival carried out to 3 decimal places is zero as far as the science is concerned, and it should be zero as far as management decisions are concerned. There is no biological meaning to carrying out survival estimates to the maximum precision and saying there would be a "small positive difference between alternatives". This conclusion is not valid, and it should be removed from the report.

Response:

The conclusion is valid and was not removed from the document because the language referenced in the comment was directly copied from the NOAA "COMPASS [report](#) (609)" (first page, fifth paragraph). NOAA's report states: "There are two aspects to the analysis, the first is a basic comparison of two alternatives to determine which provides the higher estimated survival.

Additionally, the model provides an estimate of the magnitude of difference between the alternatives. In the case of the AMT analyses the magnitude of most estimated survival differences were small, many so small that when the absolute and relative differences were rounded to the same level of precision reported in the FCRPS BiOp the result was zero. However, when carried out to the maximum number of decimal places used in the model there was a difference between alternatives. *The significance of such small differences is somewhat debatable, however we [NOAA] would interpret them as very small positive (in most cases) or negative effects.* No change was made to the document.

Comment:

Page 38, paragraph 1, last sentence: The transport statement should not be attributed to AMT, since it does not represent the views of all AMT members and participants, including the Corps. Transportation is one of a number of management options considered in the Federal analysis, as well as the analyses by the Fish Passage Center and USFWS. Assumptions about river management are embedded in all the AMT analyses, and they cannot be ignored in discussions about effects of maintaining or removing the 115% forebay limit.

Response:

Ecology and DEQ understand that transport was included in some of the analyses that were presented at the TDG AMT. However, Ecology and DEQ identify transport as a management decision, which is discussed and decisions are made outside of the TDG AMT process. The document was changed to specify that the states consider transport to be a management issue.

Comment:

Page 36, 3rd Paragraph, Last Sentence – Should be changed to: Differences in survival presented at the AMT can be found in Table 8 and Table 9.

Page 38, 1st Paragraph, 1st Sentence – Should be changed to: The COMPASS analysis...

Response:

Ecology and DEQ agree with the comment, and have made the appropriate change in the document.

Synthesis of FPC, USFWS, NOAA and CRITFC Analyses

Comment:

The synthesis of results prepared by ODEQ and Ecology incorrectly summarized the results of the NOAA-F COMPASS analysis. While there may be a small relative benefit to in-river survival, the authors did not consider the results that are most likely to occur under real world conditions.

Not all stocks experienced an improvement in in-river survival by removing the 115% TDG standard.

- The survival of steelhead originating from the Mid-Columbia River decreased due to removal of the 115% TDG standard.
- The overall (system) juvenile survival rate of ESA-listed Snake River spring/summer chinook and steelhead would be reduced.
- The adult return rate for Snake River steelhead would be reduced by over 1%.

Response:

Ecology and DEQ agree that the information relating to decreased survival and SARs should be included in the synthesis of results section. The appropriate change was made to the document.

Comment:

Page 40, Synthesis of FPC, USFWS, NOAA and CRITFC Analyses: This section treats all the analyses equally and therefore is incomplete. Which of these conclusions is the most valid, in the view of the states? Why are they more valid? What conclusions do you draw from the information provided? This is a key part of the states' decision rationale and it is an essential part of the final report.

Response:

Ecology and DEQ will use the full range of analyses and results presented at the TDG AMT to develop the agencies' decision. Additionally, Ecology and DEQ have included a write-up on the Weight of Evidence approach and how it was implemented in the "Agencies' Decisions" section of the report. No change was made to the document.

Comment:

Page 40, paragraph 1, sentence 2: The "simulated" data in the Federal modeling analyses are based on empirical data. There is significant overlap and consistency between the two types of information.

Response:

Ecology and DEQ agree with the comment, and have made the appropriate change in the document (see Table 7 of the draft document titled “Fish Passage and Survival Impacts Analysis Summary”).

Gas Bubble Trauma Impacts

Ecology Literature Review

Comment:

Page 46, paragraph 5: The Ecology literature review was the most thorough of the reviews submitted to AMT. It has important recommendations on page 5 that should be included in this paper. Ecology noted that significant data gaps exist in a number of important areas related to TDG impacts on fish and other species, and that, until more is known about effects, caution is advised. The Corps and BPA support this conclusion.

Response:

Comment noted. The conclusions from the Ecology literature review are identified in pages 2-5 of the review. Like the other reports summarized by the document, only the highlights are included. The complete literature review is available on the AMT website.

Comment:

The Ecology literature review appears to indicate that for several laboratory and shallow water and lentic studies, 120% TDG levels may be harmful to fish and invertebrates. However, these studies are not likely representative of conditions in the lotic, Columbia River. It is likely that gas levels would dissipate below dams in the thalweg areas before concentrating in shallow water environments. In a weight of evidence appraisal, it is important that Ecology and DEQ consider the actual dynamic river environment before considering transferring lab and shallow water studies to the Columbia River.

Response:

Ecology and ODEQ are careful to consider the dynamic river environment in making their conclusions. Laboratory studies clearly show a significant harmful effect in shallow water. The impact of higher TDG on aquatic life in the Columbia River is more difficult to determine.

Comment:

The authors correctly find that long-term effects of elevated TDG have not been properly studied. The effects of long-term exposure on fish and other aquatic biota are unknown at this time. Under current spill operations, the 110% TDG level is exceeded for several months each year. These analyses do not adequately assess long-term chronic effects on fish and other aquatic organisms. Removing the 115% TDG forebay constraint would only exacerbate any negative effects we have yet to identify.

Response:

Comment noted. The long-term effects on salmonids are better known than the long-term effects on other aquatic life.

GBT Monitoring Program

Comment:

Page 52, GBT Monitoring Program, Table 18: The FPC results show an upswing in external signs of gas bubble trauma in sampled fish when TDG levels approach or exceed 115% of saturation at the tailrace of the next project upstream. This indicates that 115% TDG may be a safer waiver limit than 120%, or at least that the 115% forebay limit should be retained if it does not cause significant survival losses at dams. In addition, gas bubble trauma signs are sometimes reported inriver when TDG levels are less than 115%. These data, combined with the results of the literature reviews, indicate that 115% TDG saturation in the river is a good measure of overall ecosystem health and may be used as an indicator of a reasonably safe condition for most aquatic organisms. TDG levels above 115% are associated with increased toxicity effects and represent a higher risk of TDG effects on aquatic species.

Response:

Gas bubble trauma signs are reported at all levels of TDG, including below 110%. GBT signs increase as TDG increases. A limit of 110% is more protective than a limit of 115% which is more protective than 120%. More discussion on the TDG limit is included in the Agencies' Decisions section of the document.

Agencies' Decisions

Comment:

Page 54, Agencies Decisions: We assume that the states will include more than the decision itself in this section. The final section should include:

- Responses to AMT members' comments on the draft synthesis report.
- Methods for weighting and results pertaining to the weighting of the various pieces of technical information.
- How AMT members' comments on technical reports throughout the process were used to weigh the technical information.
- Decision rationale: Which information is most relevant to the question, and how the technical information leads to the states' decision.
- How the decision helps move the lower Columbia and Snake rivers water bodies towards the TMDL goal of attaining the 110%/105% TDG water quality standard.

Response:

Ecology and DEQ will use the full range of analyses and results presented at the TDG AMT to develop the agencies' decision. Additionally, Ecology and DEQ have included a write-up on the Weight of Evidence approach and how it was implemented in the "Agencies' Decisions" section of the report.

Comment:

The results of the federal analysis of found no compelling reason for eliminating the 115% Total Dissolved Gas (TDG) forebay standard at dams in the Lower Snake and Lower Columbia Rivers. Our analysis of the information summarized in this synthesis report also supports the States maintaining the current TDG standard. The U.S. Army Corps of Engineers is working on an extensive program toward meeting water quality standards. Eliminating the 115% TDG standard will not provide any appreciable benefits to salmon and steelhead in the Columbia River Basin and will further reduce protection for fish and other aquatic organisms. The following provides further explanation of our conclusions.

Response:

Other AMT members disagree with each of these conclusions. ODEQ and Ecology made the best attempt possible to evaluate the 115% TDG forebay requirement question.

Comment:

We are pleased that Ecology and DEQ have adopted a weight of evidence approach as an information and decision making tool in this process. However, while the draft paper summarizes well the issues and analysis in the process, the final part of the paper does not appear to use the weight of evidence approach to offer definitive conclusions regarding the hypotheses and arguments for and against eliminating the 115% TDG forebay requirement for protection of the beneficial fisheries use. This includes but is not limited to the information presented to the AMT describing the role of spill in juvenile and adult fish survival, the impacts of TDG on biota based on gas bubble trauma monitoring conducted over the past decade, the accuracy of forebay monitors with respect to upstream dam TDG generation and predicted outcomes based on different modeling approaches. This is a critical point that needs to be addressed in the final synthesis paper.

Response:

Ecology and DEQ will use the full range of analyses and results presented at the TDG AMT to develop the agencies' decision. Additionally, Ecology and DEQ have included a write-up on the Weight of Evidence approach and how it was implemented in the "Agencies' Decisions" section of the report.

Comment:

We suggest that the weight of evidence approach discussed in the AMT play an important role when developing the Agencies' recommendation. The agencies' should determine if sufficient information has been provided to assess the potential benefit to fish survival from the removal of the forebay TDG gauge from in-season spill management. The weight of evidence approach can be used to assess the relative importance of the information presented to the AMT describing the role of spill to fish survival, the impacts of TDG based on gas bubble trauma monitoring conducted over the past 14 years, as well as expected outcomes based on modeling approaches.

Response:

Ecology and DEQ will use the full range of analyses and results presented at the TDG AMT to develop the agencies' decision. Additionally, Ecology and DEQ have included a write-up on the Weight of Evidence approach and how it was implemented in the "Agencies' Decisions" section of the report.